Name:

Botkin & Keller: Environmental Science: Earth as a Living Planet- 8th Ed.
Chapter #6- The Biogeochemical Cycles

Read, *"Case Study: Methane and Oil Seeps: Santa Barbara Channel"*
Answer the following questions:

1: What *types of organisms* inhabit the Santa Barbara Channel?

2: Where ("what") did the hydrocarbons **come from** that are found in the Santa Barbara Chanel?

3: When hydrocarbon gases are in the atmosphere, they mix with sunlight to produce **what**?

4: *What happens* to most of the hydrocarbons that are released in the ocean?

5: **Explain** how the processes that are occurring in the Santa Barbara Channel are part of the natural Carbon Cycle.

6.1- Earth is a Peculiar Planet

1: What is the *approximate composition* of the Earth's atmosphere?

The Rise of Oxygen

1: *Summarize* how atmospheric Oxygen came about on Earth.

2: *What happens* to Oxygen when it enters seawater? How can looking at ocean sediments help us to determine what happened long ago?

Life Responds to an Oxygen Environment

1: Explain why prokaryotes suitable for living in an anoxic (no Oxygen present) environment.

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6.2: Life and Global Chemical Cycles

1: What are the "big 6" macronutrients that are needed for life?

2: What is a *"limiting factor"*?

6.3: General Aspects of Biogeochemical Cycles

1: What is **biogeochemical cycling**? *Give an example.*

2: *Define the following terms:*

*** Flow:**

*** Flux:**

*** Residence Time:**

*** Source:**

*** Sink:**

6.4: The Geologic Cycle

1: The **Geologic Cycle** is a combination of what 4 cycles?

2: What is the **lithosphere**?

3: What is the theory of *"Plate Tectonics"*? *How fast do plates move (on average)?*

4: How does plate movement impact the environment?

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5: Explain the *3 types of plate boundaries*

Plate Boundary	Description (Where found?)
Divergent Plate Boundary	
Convergent Plate Boundary	
Transform Plate Boundary	

The Hydrologic Cycle

1: What are the approximate percentages of reservoirs of water on Earth?

2: Explain how the rate of transfer from the oceans, land and atmosphere is not constant.

3: What is a drainage basin (or Watershed/Catchment)?

The Rock Cycle

1: **Draw and label** the rock cycle below:

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The Carbon Cycle

1: *Which element* is the most abundant in the Earth's crust?

2: In *what forms (3)* do we find Carbon Dioxide in the ocean?

3: Which **two important greenhouse gases** are made up of Carbon?

The Carbon-Silicate Cycle

1: What does weathering of silica rich rocks on the land release into rivers and back into the oceans? *Which organisms* uses these materials?

2: Explain the **lithosphere to atmosphere flux** of Carbon.

The Nitrogen Cycle

1: *Why* is Nitrogen so important to life on Earth?

2: *In which form* do we find atmospheric Nitrogen? *What percentage?*

3: *In which form(s)* do plants need Nitrogen to be in so that they can use it?

4: How is atmospheric Nitrogen converted to a usable form in the atmosphere?
In the soil?

5: *Converting* **atmospheric Nitrogen to ammonia, nitrite or nitrate** is called:

6: *Converting* **biologically available Nitrogen back to atmospheric Nitrogen** is called:

7: Why can plants in the "Pea family" grow in Nitrogen poor environments?

8: Where does **Industrial Nitrogen** come from?

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The Phosphorus Cycle

1: Why is phosphorus so important to life?

2: Why is it considered to be a *"limiting nutrient"* in the biosphere?

3: What is **special** about the phosphorus cycle?

4: **Explain** how the oceans and oceanic organisms contribute to the phosphorus cycle.

5: What is *"Guano"* and what was it once used for? What do we use for that product now?

6: **Summarize** some of the environmental issues associated with the use and depletion of phosphorus:

7: What are some of the author's suggestions to help with the phosphorus issues? **Pick one** to discuss in detail.

Critical Thinking Issue: How Are Human Activities Linked to the Phosphorus and Nitrogen Cycles?

1: The supply of phosphorus fro mining is a limiting resource. In the United States, extraction is decreasing, and the price is rising dramatically. Do you think phosphorus can be used sustainably? How? If not, what are the potential consequences for agriculture?

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2: Do you think phosphorus use should be governed by an international body? Why or why not?

3: Compare the rate of human contributions to nitrogen fixation with the natural rate.

4: How does the change in fertilizer use relate to the change in world population? Why?

5: Develop a diagram to illustrate the links between the phosphorus, nitrogen and carbon cycles?

6: Make a list of ways in which we could modify our activities to reduce our contributions to the phosphorus and nitrogen cycles.

7: Should phosphorus and nitrogen be used to produce corn as a biofuel? Why or why not?

End of Chapter: Study Questions
1: Why is an understanding of biogeochemical cycles important in environmental science? Explain.

2: What are some of the general rules that govern biogeochemical cycles, especially the transfer to material?

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3: Identify the major aspects of the carbon cycle and the environmental concerns associated with it.

4: What are the differences in the geochemical cycles for phosphorus and nitrogen, and why are the differences important in environmental science?

5: What are the major ways that people have altered the biogeochemical cycles?